

Town of Royalton, Vermont
Local Hazard Mitigation Plan
September 2014 Draft

**Prepared by the Two Rivers-Ottawaquechee Regional Commission and
the Town of Royalton**

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I. Introduction

Natural and human-caused hazards may affect a community at any time. They are not usually avoidable; however, their impact on human life and property can be reduced through community planning. Accordingly, this Plan seeks to provide an all-hazards mitigation strategy that will make the community of Royalton more disaster resistant.

“Mitigation” is defined as any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Previous Federal Emergency Management Agency (FEMA), State and Regional Project Impact efforts have demonstrated that it is less expensive to anticipate disasters than to repeatedly ignore a threat until the damage has already been done. While hazards cannot be eliminated entirely, it is possible to identify prospective hazards, anticipate which might be the most severe, and recognize local actions that can be taken ahead-of-time to reduce the damage. These actions, also known as ‘hazard mitigation strategies’ can (1) avert the hazards through redirecting impacts by means of a structure or land treatment, (2) adapt to the hazard by modifying structures or standards or, (3) avoid the hazard through improved public education, relocation/removal of buildings in the flood zone, or ensuring development is disaster resistant.

II. Purpose of the Plan

The purpose of this Hazard Mitigation Plan is to assist Royalton in identifying all hazards facing the town, ranking them, and identifying strategies reduce risks from known priority hazards.

The Town of Royalton seeks to be in accordance with the strategies, goals, and objectives of the State Hazard Mitigation Plan.

The 2014 Royalton Local Hazard Mitigation Plan is the first stand-alone mitigation plan drafted for the Town. Previously, the Town had a town-specific 2011 Annex in the Regional Pre-Disaster Mitigation Plan. This new plan has been reorganized and new sections have been added:

- Program eligibility subsequent to plan approval
- Authority for plan development
- Participating jurisdictions
- Funding for plan development
- Brief information about the community

Old assumptions have been challenged throughout and new information has been added to make the plan stronger and more useful for the Royalton town officials and residents who will implement the hazard mitigation strategies in the future.

III. Community Profile

Situated on the White River and its First and Second branches, Royalton's 25,815 acres include rich, level, bottom land which has provided a livelihood for generations of farmers. Moving away from the rivers, the land changes quickly to rugged, rocky hillsides, which have historically limited agricultural, residential and commercial development. The Town is bisected by Interstate 89 and Vermont Route 14, as well as New England Central Railroad and Amtrak rail lines. The Vermont Law School campus is situated in South Royalton village. There are approximately 380 students that attend the Law School and approximately 100 professors and administrative staff who work at the Law School.

According to the U.S. Census Reports, there were 2,603 people living Royalton in 2000, and by 2010, that number had risen slightly to 2,773. That represents a percent change of 95.57% during this period (1950 – 2000). The average increase for the Two Rivers-Ottawquechee Region during this time frame was 55.69%.

Royalton's electric power supply comes from Green Mountain Power (GMP) and the source is a combination of hydro, nuclear, and fossil fuel. High electric rates discourage electric heat. There is one power substation in Town and no generating stations. LP (liquefied propane) gas, oil, kerosene and wood fuels are available to Royalton residents from various private suppliers.

Fire protection for the Town is provided by the South Royalton Volunteer Fire Department, an all-volunteer department, located in South Royalton Village. The fire department is independently organized as Royalton Fire District No. 1, formed in 1884, and is not under the Town's jurisdiction. Currently recognized fire protection problems include: development in areas distant from the village of South Royalton, development on class 3 and 4 roads, tightly packed trailer parks, distance from water sources (rivers, hydrants and/or fire ponds), and inadequate snow removal (for building access).

The South Royalton Rescue Squad, operated independently by the Fire Department, provides ambulance service to Royalton, Sharon, and special local events. The South Royalton Firehouse holds the ambulance and emergency services are provided by the Rescue Squad through Town appropriations. The Fire Department and the Rescue Squad function as first back up to Tunbridge Fire Department and First Branch Rescue. The closest hospital is Gifford Medical Center, located in Randolph. Medivac services are available by the DHART helicopter.

Royalton has two elected, part-time Town Constables. A Royalton Police Department was established in 2005. Back up is provided by the Vermont State Police, Troop "D" located in Royalton.

IV. The Planning Process

A. Plan Developers

Samantha Holcomb and Ellie Ray, both Land Use Planners at the Two Rivers-Ottawaquechee Regional Commission (TRORC), assisted the Town of Royalton with updating its Hazard Mitigation Plan.

This section of the Plan satisfies 44 CFR 201.6(b)(1) and 201.6(c)(1) (or, A3.a and A3.b of FEMA's Local Mitigation Plan Review Guide, 2011).

The core planning team was comprised of the following individuals:

Name	Role/Organization	How Participation Was Solicited
Peggy Ainsworth	Royalton Selectboard	On 2/7/2013, TRORC staff sent an introductory letter and e-mail to Selectboard members (Larry Trottier, Ernie Amsden, Joan Goldstein, Peggy Ainsworth, and Phillip Gates), and Emergency Director/Coordinator (Gidget Lyman). In this letter, TRORC's staff requested names and contact information for potential committee members to revise Royalton's HMP. The Town of Royalton responded with a list of individuals, and TRORC scheduled an introductory to begin the update process. This meeting was followed by many more in which participants revised the HMP (see meeting details below for specifics).
Phil Gates	Royalton Selectboard	
Jo Levasseur	Former Royalton Planning Commission Chair & Flood Hazard Review Board	
Joshua Powers	Royalton Planning Commission	
Gidget Lyman	Royalton Emergency Coordinator	
Rose Hemond	Administrative Manager	
Paul Brock	South Royalton Fire Department Chief	
Walter Hastings	Lister, Floodplain and Zoning Administrator, White River Partnership	
Roger McCrillis	Royalton Highway	
Dave Palmer	Royalton Rescue Squad Director	
Dennis Stern	Emergency Planning, Vermont Law School (has since retired)	

Additional Participants:

- Wayne Manning; Operator, Water Department, Royalton Fire District #1

B. Plan Development Process

The 2011 Royalton Annex was originally part of the 2008 multijurisdictional Regional Hazard Mitigation Plan, drafted by Two Rivers-Ottawaquechee Regional Commission, and approved by FEMA on September 30, 2008 with its first local annex. The Royalton Annex received FEMA approval on September 30, 2008, but since it was part of a larger plan, FEMA treats its start date as September 30, 2008, and so the Royalton Annex expired on September 30, 2013.

This section of the Plan satisfies the Element A: Planning Process requirements set out in 44 CFR 201.6.

This Plan has been reconstructed as a single jurisdiction, standalone Royalton Local Hazard Mitigation Plan that will be submitted for individual approval to FEMA. As such, several sections have been added or updated to include all necessary information.

The changes to this Plan include:

- **General**
 - New sections: Plan Development Process, 2011 Mitigation Strategies Status Update chart, Existing Hazard Mitigation Programs, Projects & Activities, Plan Maintenance;
 - Data updates: New hazard incidents, emergency declarations, census data;
 - Hazards have been reevaluated with the hazard ranking system used by the Vermont Division of Emergency Management and Homeland Security.
- **Hazards Analysis**
 - Water Supply Contamination and Severe Weather are now on the list of Top Hazards;
 - Severe Weather events are depicted in a chart which documents the multiple hazards involved during each event;
 - For each hazard, a location/vulnerability/extent/impact/likelihood table has been added to summarize the hazard description.
- **Maps**
 - Added a map of the Town of Royalton depicting critical facilities, town infrastructure, and the NFIP designated floodway and 100 year floodplain.

The following represent the avenues taken to draft the Royalton Hazard Mitigation Plan:

- **Activities**
 - 2/7/13: Introductory letter and email indicating that the Town's HMP would soon expire and explaining the process for revising and readopting the HMP. Requested names and contact information for potential committee members to revise HMP. Sent to Selectboard members (Ernie Amsden, Phillip Gates, Joan Goldstein, Larry Trottier, and Peggy Ainsworth).
 - 5/9/13: Met with Gidget Lyman (Emergency Coordinator), Rose Hemond (Admin. and Finance Manager), and David Palmer (Ambulance/Fast Squad). Introduced the revision process, reviewed Royalton's existing Hazard Mitigation Plan (adopted in April, 2011),

considered the status of various mitigation actions, potential hazards, and the data collection/research process. Set goals and scheduled the next meeting.

- 8/7/2013: Met with Town representatives, including Fire Chief Paul Brock, to review the Mitigation Actions identified in the Town's 2011 Plan, discuss existing Hazard Mitigation projects, and identify and rank hazards to focus on in the HMP update.
- 9/16/13: Met with town officials, the Emergency Coordinator and residents to discuss and review list of Royalton's existing hazard mitigation activities/programs/projects. Then used hazard ranking methodology to determine the hazards that would be focused in this Hazard Mitigation Plan.
- 12/18/2013: Met with members of the Hazard Mitigation Plan committee to review and revise the first draft of the Hazard Mitigation Plan.
- 03/20/2014: With the help of TRORC staff, the update committee discussed and identified the mitigation actions/projects/programs to be included in the 2014 Hazard Mitigation Plan.
- _____: TRORC staff attended a Selectboard meeting to inform Royalton residents about the work that had been done to update the Town's Hazard Mitigation Plan. The Selectboard agenda is posted at the Town Office, and the draft Hazard Mitigation Plan was posted on the Town's website in advance of the public information session. TRORC staff also asked for comments at the meeting, but none were received.
- ____: A notice was posted in ____ from ____ to ____ to alert community members that a public hearing with the Royalton Selectboard would be taking place. A public hearing to adopt the final draft was held. The Selectboard adopted the Royalton Hazard Mitigation Plan on _____.
- **Public participation and involvement (44 CFR 201.6(b)(1))**
 - October 2013: A notice was placed in the Two Rivers-Ottawaquechee Regional Planning Commission Newsletter alerting recipients that Royalton was engaging in hazard mitigation planning and updating their Hazard Mitigation Plan.
 - Posted a notice in four local papers alerting the public to the Hazard Mitigation Planning process that was taking place.
 - Valley News—ran October 23, 2013
 - The Herald of Randolph—ran October 24, 2013
 - Journal Opinion—ran October 23, 2013
 - Vermont Standard—ran October 24, 2013
 - _____: TRORC staff attended a Selectboard meeting to inform Royalton residents about the work that had been done to update the Town's Hazard Mitigation Plan. The Selectboard agenda is posted at the Town Office, and the draft Hazard Mitigation Plan was posted on the Town's website in advance of the public information session. TRORC staff also asked for comments at the meeting, but none were received.
 - ____: A notice was posted in ____ from ____ to ____ to alert community members that a public hearing with the Royalton Selectboard would be taking place. A public hearing to adopt the final draft was held.

- **Governmental participation and involvement** (44 CFR 201.6(b)(2))
 - Sent revised draft to the Selectboard Chair—September 29, 2014
 - Sent revised draft to the Planning Commission Chair— September 29, 2014
 - Sent revised draft to Vermont Division of Emergency Management and Homeland Security—
- **Neighboring community participation and involvement** (44 CFR 201.6(b)(2))
 - October 2013: A notice was placed in the Two Rivers-Ottawaquechee Regional Planning Commission Newsletter alerting recipients that Royalton was engaging in hazard mitigation planning and updating their Hazard Mitigation Plan.
 - Posted a notice in four local papers alerting the public to the Hazard Mitigation Planning process that was taking place.
 - Valley News—ran October 23, 2013
 - The Herald of Randolph—ran October 24, 2013
 - Journal Opinion—ran October 23, 2013
 - Vermont Standard—ran October 24, 2013
 - Sent revised draft to neighboring Selectboards for comment— September 29, 2014
 - Towns of: Tunbridge, Sharon, Barnard, and Bethel
 - Sent revised draft to Vermont Law School for comment— September 29, 2014
 - Sent revised draft to the South Royalton School for comment— September 29, 2014
- **Review of existing plans, studies, reports, and technical information** (44 CFR 201.6(b)(3))
 - Royalton Hazard Mitigation Plan (Adopted 04/29/2011)
 - This Plan was referenced extensively during the plan development process, especially in regard to the worst threats and mitigation action strategies identified in 2011.
 - Royalton Town Plan (Adopted 03/02/2010)
 - This Plan provided TRORC’s staff with background information on the community, as well as more detail on their emergency services.
 - The Town Plan is updated every five years, as required by statute.
 - Royalton Flood Hazard Area Regulations (Adopted 09/25/2007)
 - The Flood Hazard Area Regulations were referenced when completing the Flood/Flash Flood/Fluvial Erosion section of this Hazard Mitigation Plan.
 - Town of Royalton, VT – Annual Report (2012)
 - This Assessment was incredibly useful for TRORC’s staff in understanding the response (and subsequent analysis of that response) following a major disaster (Tropical Storm Irene in 2011). This Assessment was discussed during the update of Royalton’s Hazard Mitigation Plan.
 - Royalton Fire District No. 1 Source Protection Plan Update (06/08/2012)
 - Royalton Fire District No. 1’s Source Protection Plan Update was referenced when drafting the Water Supply Contamination section of this Plan.

This section of the Plan satisfies 44 CFR 201.6(b)(3) (or, A4.a and A4.b of FEMA’s Local Mitigation Plan Review Guide, 2011).

- White River Tactical Basin Plan (Approved 07/13/2013)
 - The White River Tactical Basin Plan was useful for understanding the “bigger picture” of the White River, the Town of Royalton being part of the White River watershed. In addition, some of the implementation actions listed in the Tactical Basin Plan were used to help develop the “hazard mitigation strategies” found in this Hazard Mitigation Plan.

C. Status Update on Mitigation Actions Identified in 2011

The following table outlines the mitigation actions that were proposed in Royalton’s 2011 All-Hazard Pre-Disaster Mitigation Plan for the Town of Royalton (adopted on April 29, 2011 as an appendix to the Two Rivers-Ottawaquechee Regional Commission’s multi-jurisdictional Pre-Disaster Mitigation Plan). Participants in the Plan update process reviewed those actions and reported on the status of each:

This section of the Plan satisfies the requirements of 44 CFR 201.6(d)(3).

2011 Mitigation Action	2014 – Status of Mitigation Actions
<u>ALL HAZARDS</u> 1. Ensure that the Basic Emergency Operations Plan (BEOP) is current.	<input checked="" type="checkbox"/> Complete. The Town of Royalton updates its Basic Emergency Operations Plan (BEOP) each year. In 2014, the BEOP was replaced with the Local Emergency Operations Plan (LEOP). The most recent copy of the LEOP was approved on 04/22/2014.
2. Use PDM plan for Hazard Identification and Mapping	<input checked="" type="checkbox"/> Currently being done/in process.
3. Re-write and update existing Emergency Operations Plan	<input checked="" type="checkbox"/> Done annually in conjunction with the LEOP.
<u>FLOOD</u> 4. Continue the planned road maintenance program and update existing culvert inventory. Upgrade culverts and ditching.	<input checked="" type="checkbox"/> In process. Town maintains up-to-date list of culverts, including updates to culverts. Three were updated in the month of August, 2013. Some of this year’s updates are: 2 on Happy Hollow Road, 1 on Mill Road, and 1 on Clarksville Road (part of Happy Hollow Road) . Updates are made to culverts as needed.
5. Review Flood Hazard Area Regulations.	Not complete. Will review with Town Plan update.
<u>FIRE</u> 6. Consider installation of fire sprinkler systems in the closely spaced historic downtown structures.	<input checked="" type="checkbox"/> In process. Systems have gone in due to renovations at sites like the Vermont Law School campus and Crossroads, as per the state Fire Marshall.
7. Develop additional dry hydrant sites in rural locations.	<input checked="" type="checkbox"/> In process. Town applies for Aiken Grants each year (this year was for Broad Brook area—a wet hydrant site). 2 were fixed in 2012 near the bridge at Chelsea Street (following TS Irene), and 2 in 2011 at Dairy Hill Rd. and North Road.
<u>HAZMAT</u> 8. Pursue HAZMAT training for Fire Department	<input checked="" type="checkbox"/> In process. HAZMAT Operation level training will commence this fall to build on existing knowledge base.

<p>9. Develop emergency access points to the railroad corridor in locations where access is presently difficult in the event of a derailment.</p>	<p><input checked="" type="checkbox"/> On-going. Rt. 107 to the Bethel line has the most problems. Amtrak has volunteered trainings, and the Town is considering training in the future.</p>
<p>10. Develop emergency access to I-89 located off of the Oxbow Rd.</p>	<p><input checked="" type="checkbox"/> In Process. Engineering costs are to be covered by the Fire Department. Still in the engineering phase at present.</p>

The Town of Royalton, like many of the surrounding towns, is overall very rural in character. However, I-89 runs through Royalton, and there is an on- and off-ramp to I-89 in the Town, not far from the Bethel-Royalton town line. The close proximity and easy access to the interstate place some additional development pressures on the interchange and surrounding areas. South Royalton serves as the village or town center for the Town of Royalton, and is home to Vermont Law School. The Town of Royalton plans to build a new Town Office in the former Crawford Auto Land building. There are no plans to develop in areas that would be vulnerable to flooding. The Town of Royalton is planning to amend their Flood Hazard Area Regulations to add river/stream corridor data, when it becomes available.

D. Existing Hazard Mitigation Programs, Projects & Activities

The Town of Royalton is currently engaged in the following hazard mitigation programs, projects and activities:

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3).

Community Preparedness Activities

- Royalton’s Local Emergency Operations Plan (LEOP) (Last Adopted 04/22/2014)
- “All-Hazard Pre-Disaster Mitigation Plan for the Town of Royalton” (Adopted 04/29/2011) as appendix to “Two Rivers-Ottawaquechee Regional Commission’s multi-jurisdictional Pre-Disaster Mitigation Plan”

Insurance Programs

- Participation in National Flood Insurance Program (NFIP)
 - Royalton’s initial Flood Hazard Boundary Map was identified on 07/19/74 and their initial Flood Insurance Rate Map (FIRM) was dated 01/16/81. The Town’s FIRM has been updated, and the current effective map date is 09/28/07. The Royalton Floodplain Administrator serves as the NFIP Administrator.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).

Land Use Planning

- Royalton Town Plan (Adopted on 02/02/2010)
 - The Town Plan is updated every five years, as required by statute.
- Royalton Flood Hazard Area Regulations (Adopted 10/25/2007)
 - During the Town Plan review/update period, the Zoning Ordinance is also reviewed and updated if needed.
- Royalton Hazard Mitigation Plan (Adopted 04/29/2011)
 - The 2014 Royalton Hazard Mitigation Plan will replace the 2011 Plan. The 2014 HMP has evolved from the 2011 Plan and has greatly expanded and improved upon it.

Hazard Control & Protection of Critical Infrastructure & Facilities

- Projects with White River Partnership
 - None currently, but the Town has worked with this organization in the past. Notably in conjunction with Vermont Law School students and local citizens on river clean-ups.
- Structures Improvement grants
 - Transferred to upgrade/replace culvert on Happy Hollow Road
- Rural Roads grants
 - Sign and guardrail replacement

Education/Public Outreach

- Community Recovery Partnership Meeting
 - Organized by the State of Vermont and partnering organizations for the following towns—Sharon, Royalton, Bethel, and Randolph—in the aftermath of Tropical Storm Irene (Aug. 2011). Meeting held on Jan. 17, 2012 in Sharon, VT.
- Distribution of 211 Fliers
- Red Cross Shelter training in June 2013

E. Plan Maintenance

This Plan (the Royalton Local Hazard Mitigation Plan) will be updated and evaluated annually at a May Selectboard meeting, along with the review of their Local Emergency Operations Plan (LEOP). This meeting will provide an opportunity for the public and other town officials to hear about the town’s progress in implementing mitigation strategies and to give input on future activities and Plan revisions.

This section of the Plan satisfies 44 CFR and 201.6(c)(4)(i), 201.6(c)(4)(ii), and 201.6(c)(4)(iii).
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Updates and evaluation of this Plan by the Selectboard and the local Emergency Coordinator/Director will also occur within three months after every federal disaster declaration. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town’s bylaws.

The Two Rivers-Ottawaquechee Regional Commission (TRORC) will help with Plan updates if assistance is requested by the Town of Royalton and if funding is available. If TRORC is unable to assist the Town, then Royalton’s Town Clerk, Administrative Assistant, or Selectboard will update the Plan, or the Selectboard may appoint a committee of interested citizens (including the current local Emergency Coordinator/Director) to draft changes.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website, notice within the municipal building, and notice in The Herald of Randolph and the TRORC newsletter and blog, inviting the public to the scheduled Selectboard (or specially scheduled) meeting. Additional stakeholders should be invited to the meeting; these include: White River Valley Ambulance, Inc., Royalton School, and the Vermont Agency of Natural Resources (VT ANR). VT ANR will be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain zoning regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Town Clerk.

Updates may include changes in community mitigation strategies; new town bylaws, zoning and planning strategies; progress on the implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities. If new actions are

identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

Royalton shall also incorporate mitigation planning into their long-term land use and development planning documents. The 2013 Vermont Legislature passed a law requiring all towns to incorporate flood resiliency elements into their town plans as of July 2014. To do so, flood hazard and fluvial erosion hazards will be identified, and strategies and recommendations will be provided to mitigate risks to public safety, critical infrastructure, historic structures and public investments. This Local Hazard Mitigation Plan will help the town to comply with the new community flood resiliency requirement for town plans adopted after July 2014.

It is recommended that the process work both ways and the Town review and incorporate elements of the Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/FEH bylaws. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas.

V. Community Vulnerability by Hazard

A. Hazard Identification

Mitigation efforts must be grounded in the rational evaluation of hazards to the area and the risks these hazards pose. This is done through a process, which in essence asks and answers three basic questions:

- What bad things can happen?
- How likely are they to occur?
- How bad could they be?

This process, which is laid out in the table below, is an attempt to inventory the known hazards, establish the likelihood of them occurring in the future, and then assess the community's potential vulnerability to each. In performing this analysis, we are then able to prioritize actions that are designed to mitigate the effects of each of these disaster types and ultimately make Royalton a safer place.

It is important that we learn from the past in order to avoid the same disasters and their outcomes. Disasters that have occurred within the Town of Royalton, the larger region, and the State of Vermont can give us good information about what types of disasters we can expect in the future and what kinds of damage they might cause. However, while this historical data can inform our perspective of what might happen in the future, it is by no means a prophecy. While Royalton might not have been impacted by a specific hazard in the past, this does not necessarily mean it will never be affected in the future. Indeed, the advance of climate change means that old weather patterns may not hold. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially rainfall events. Armed with historical data and a healthy respect for climate change and the unknown, we have tried our best to identify hazards and prepare for the future.

The following table reflects the hazards that we believe can be expected, or are at least possible, in the central Vermont area. We have considered factors such as frequency of occurrence, warning time and potential community impact to rank each and determine which hazards pose the greatest threats to life and property in Royalton.¹ The worst threats (bolded in the table, below) are then followed-up with discussion and mitigation strategies throughout the rest of this Plan.² It should be noted that hazards assigned with the same "Hazard Score" are not in order and their placement in the table should not be assumed to reflect their potential to create hazards for the town.

¹ The ranking methodology used in this Plan (see Appendix A) is closely modeled on that which is used by the Vermont Division of Emergency Management & Homeland Security (VDEMHS). The only changes made were intended to reflect the more limited geographical scope of this analysis, which is focused on a small, rural town rather than the entire State of Vermont (which is the focus of VDEMHS).

² It's important to note that those hazards which were not found to pose the greatest threats may still occur in Royalton's future; however, they are not the focus of this Plan.

Hazard	Frequency of Occurrence	Warning Time	Potential Impact	Hazard Score
<i>Structural Fire</i>	<i>Highly Likely</i>	<i>None to Minimal</i>	<i>Moderate</i>	<i>11</i>
<i>Flash Flood/Flood/Fluvial Erosion</i>	<i>Highly Likely</i>	<i>None to Minimal</i>	<i>Minor</i>	<i>10</i>
<i>Water Supply Contamination</i>	<i>Occasionally</i>	<i>None to Minimal</i>	<i>Major</i>	<i>10</i>
<i>Severe Weather (Thunderstorm, Lightning, High Winds, Hail, and Flooding)</i> <i>*Note: We have defined 'Severe Weather' to include two or more of the above listed hazards.</i>	<i>Highly Likely</i>	<i>3-6 hrs.</i>	<i>Minor</i>	<i>9</i>
<i>Hazardous Material Spill</i>	<i>Unlikely</i>	<i>None to Minimal</i>	<i>Major</i>	<i>9</i>
Landslides/Mudslides	Highly Likely	None to Minimal	Negligible	9
Dam Failure	Unlikely	None to Minimal	Major	9
Lightning	Likely	3-6 hrs.	Minor	8
Extreme Cold/Snow/Ice Storm	Highly Likely	6-12 hrs.	Minor	8
High Wind	Highly Likely	6-12 hrs.	Minor	8
Ice Jams	Likely	3-6 hrs.	Minor	8
Tornado	Unlikely	None to Minimal	Moderate	7
Hurricanes/Tropical Storms	Likely	12+ hrs.	Moderate	7
Earthquake	Occasionally	None to Minimal	Negligible	7
Wildfire	Unlikely	None to Minimal	Negligible	6
Hail Storm	Occasionally	3-6 hrs.	Negligible	6
Drought	Unlikely	12+ hrs.	Minor	4
Extreme Heat	Unlikely	12+ hrs.	Negligible	3
Avalanche	N/A	N/A	N/A	N/A
Invasive Species/Infestation	N/A	N/A	N/A	N/A
Tsunami (Vermont is landlocked.)	N/A	N/A	N/A	N/A
Volcano (Vermont has no active volcanoes.)	N/A	N/A	N/A	N/A

After engaging in discussions using their best available knowledge, the Town of Royalton identified the following “top hazards” which they believe their community is most vulnerable to:

- Structural Fire
- Flash Flood/Flood/Fluvial Erosion
- Water Supply Contamination
- Severe Weather (Thunderstorm, Lightning, High Winds, Hail, and Flooding)
- Hazardous Material Spill

Each of these “top hazards” will be discussed in the following sections. Within each section, previous occurrences of each hazard will be listed, including the County-wide FEMA Disaster Declarations (DR-#), where applicable. Hazards information was gathered from local sources (ex. town history book), the National Climatic Data Center’s (NCDC’s) Storm Events Database (1950-2012 and 2006-2012), the Spatial Hazard Events and Losses Database for the United States (SHELDUS) 1960-2012, and Special Reports produced by the National Weather Service in Burlington, Vermont. This section also includes a description of each “top hazard” and a hazard matrix that will also include the following information (please see each hazard profile for a hazard-specific matrix):

Hazard	Location	Vulnerability	Extent	Anticipated/ Observed Impact	Likelihood/Probability
Type of hazard.	General areas in community that may be vulnerable to the hazard.	Community structures affected by hazard.	General details of the most notable event(s).	Dollar value or percentage of damages.	<u>Occasionally:</u> 1–10% probability of occurrence per year, or at least one chance in next 100 years <u>Likely:</u> >10% but <100% probability per year, at least 1 chance in next 10 years <u>Highly Likely:</u> 100% probable in a year

B. Hazard Profiles of Top Hazards

1. Structural Fire

Vermont has one of the highest per capita death rates from fire in the nation. This is in fact the deadliest form of disaster throughout the state. In 2012, there were 2,225 reported structural fires in the state, which included 6 fatalities and \$17.8 million dollars in damage. Although there have been requirements for smoke detectors in rental housing for over 20 years, and requirements for smoke detectors in single-family dwellings since 1994, there was only one building involved in the fatal fires in 2000 that had evidence of working smoke alarms.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Structure Fire**.

Structure fires may occur at any point, and are typically initiated within a single fuel object. Smoke produced by the burning object forms a smoke plume and rises, creating a layer of smoke while also transporting heat to the smoke layer. Fire then spreads quickly by radiation from the flames, or from the smoke layer. Once other objects are engulfed, more smoke plumes are formed and heat radiates to other objects. Fire burns and moves across different materials depending on the material's composition, orientation, surface to mass ratio and air supply in the structure/room.

The Town of Royalton is divided into two main areas: Royalton and the Village of South Royalton. The former runs predominantly along Route 14, with the majority of buildings clustered centrally around a community green space, including town buildings. This town area is typified by a number of old wooden town buildings, residences, and a few commercial garage spaces. South Royalton, in contrast, is much more densely populated, and includes a brick commercial block to one side of the town green. South Royalton is comprised of a large cluster of buildings on the Vermont Law School campus and an array of residences and businesses alongside the green. The local school and other residential buildings radiate away from the green.

Royalton has three mobile home parks, one of which is managed by the Twin Pines Housing Trust. These three sites have enough lots available to house up to thirty-nine families, if used to full capacity. A structural fire in any one of the mobile homes has the potential to spread to other structures located nearby in the right conditions, as would be true of houses and business in the Royalton and South Royalton centers. A review of the fires listed in the "History of Occurrences" chart below demonstrates the potential for structures located in the rural Town of Royalton to be completely or severely destroyed by fire.

The following occurrences were reported by the Committee or obtained from local sources. It is reasonable to assume that more structural fires have occurred in the period of time between the entries listed below.

History of Occurrences:

Date	Event	Location	Extent
07/22/2014	Structure fire	New Street	Barn/garage badly damaged/destroyed.
04/10/2014	House fire	Pleasant Street	Home destroyed, damages in excess of \$75,000.
08/15/2012	House fire	Putt Road	Suspected arson attack. Fire set in four separate places. Fires caused \$3,000 in property damage.
07/25/2008	House fire	Oxbow Road	Home completely burned to the ground overnight under suspicious circumstances.
11/18/1999	House fire	Route 14	Working fire
1963	Block fire	South Royalton	Half of South Royalton block burned

As noted, recognized fire protection problems for the community include the following: development in areas distant from the village of South Royalton, development on class 3 and 4 roads, tightly packed trailer parks, distance from water sources (rivers, hydrants and/or fire ponds), and inadequate snow removal (for building access). Most recently, dry hydrants have been located on the following roads/in the following areas: on Broad Brook Road near the intersection of Parkhurst Road, near the bridge at Chelsea Street, Dairy Hill Rd and North Road.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Structural Fire	Town-wide	All housing, municipal buildings, retail block in South Royalton	Depends on the location and extent of the fire.	Varies depending on the location and extent of the fire.	Highly likely

2. Flash Flood/Flood/Fluvial Erosion

Flooding is one of the worst threats to Royalton’s residents and infrastructure. Past instances of flooding in Royalton have included rain and/or snowmelt events that cause flooding in the major rivers’ floodplains and intense rainstorms over a small area that cause localized flash flooding. Both kinds of events can be worsened by the build-up of ice or debris which can contribute to the failure of important infrastructure (such as culverts, bridges, and dams).

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Flash Flood/Flood/Fluvial Erosion**.

Perhaps the worst flood disaster to hit the Town of Royalton, as well as the overarching region and the State of Vermont, occurred on November 3, 1927. This event was caused by nearly 10 inches of heavy rain from the remnants of a tropical storm that fell on frozen ground. Eighty-four Vermonters, including the Lieutenant Governor, were killed. The flooding in the White River valley was particularly violent, with the river flowing at an estimated 900,000 gallons per second on the morning of the 4th (Vermont Weatherbook). Like many towns in the region, the Town of Royalton received heavy precipitation.

A more recent flood that devastated the region and the state was the result of Tropical Storm Irene, which occurred on August 28, 2011. Record flooding was reported across the state and was responsible for several deaths, and millions of dollars of home, road and infrastructure damage. Due to the strong winds, 50,000 Vermont residents were initially without power, and many did not have electricity restored to their homes and businesses for over one week. Despite the damage wrought, the flooding caused by Tropical Storm Irene is considered to be the second greatest natural disaster in 20th and 21st century Vermont, second only to the Flood of 1927.

The Town of Royalton suffered major damage to property and infrastructure during Tropical Storm Irene, although no lives were lost. It is estimated that Tropical Storm Irene dropped 4-5 inches in the Town of Royalton in a very short span of time, and 4-7 inches across the county. Many of Royalton’s roads and culverts were damaged by the storm, including parts of: Bridge Street, Broad Brook Road,

Gilman Road, Happy Hollow Road, Mill Road, North and South Windsor Streets, Oxbow Road, Parkhurst Road (Hwy 55), Royalton Hill Road, and Russ Hill Road. Approximately 90 properties were damaged including; 25 homes, 12 other structures, 13 businesses and the remaining properties damaged were land damage to fields, lawns and driveways. The Royalton Listers adjusted about \$3 million in building damage. Twenty of the properties damaged were being used for farm land (corn, hay, vegetable and pasture), and 3 were working farms. Crop damage in the White River valley in Royalton was estimated between \$120,000 to \$150,000.

The county-wide damage totaled \$32.5 million, and Town-wide damage was over \$2 million for this flooding event. The Vermont Law School campus suffered significant damage due to the flooding. A faculty house owned by the Law School was flooded, the School’s lower parking lots were severely damaged, and the basement of the library was flooded which required months of cleanup and renovation work to fix. Following the flooding, the state of Vermont and FEMA has been coordinating on the home buy-out process across the state. At this time, there are potentially four home buy-outs in Royalton: Royalton Hill Road, Gilman Road, Route 14, and Bridge Street.

Unfortunately, flooding is very common across the region, with many events impacting the Town of Royalton specifically. The following list indicates the history of occurrence with regard to this hazard in Windsor County and given the relatively small population of Royalton, town-specific data is somewhat limited. Federal disaster numbers are listed where appropriate; Royalton-specific events are denoted with an asterisks (*).

History of Occurrences:

Date	Event	Location	Extent
Period of 06/25/2013— 07/11/2013* (DR 4140 VT)	Flooding	County and region wide	Damage totaling \$25,160.25 in Royalton. Washouts on Gage Road and a culvert replacement, Washouts on Post Farm Road, Clarksville Road. Washout and a culvert replacement on Mill Road. Most expensive was Mill Road work.
08/28/2011* (DR 4022 VT for period of 08/26/2011 – 09/02/2011)	Severe Flash Flooding	Royalton, county/region wide	4-7” of rain across region, 4 to 5” in Royalton. Significant damage to state and local roads/culverts/bridges. Numerous roads, culverts, and bridges in the region were adversely impacted. Low-lying areas sustained flood damage in the Town. Following the storm, there was very limited access to and from the Town, with the majority of roads being inaccessible for nearly a full day after rains subsided, including the bridge at Chelsea Street leading into South Royalton.
05/26/2011 – 05/27/2011 (DR 4001 VT)	Flash & riverine flooding	County-wide	3-5+” of rain county-wide
07/21/2008— 08/12/2008 (DR 1790 VT)	Flooding	County-wide	Town specific data unavailable.
07/09/2007— 07/11/2007 (DR 1715VT)	Flash flooding	County-wide	Town specific data unavailable.
05/14/2006	Flooding	County and region wide	3-6 inches of rain fell throughout Windsor County, causing road washouts in places.

Date	Event	Location	Extent
10/29/2003*	Flooding	County and region wide	Rain fell on soil that was heavily saturated from previous storms, causing streams and rivers to rise. The White River caused low land and field flooding in the Royalton area.
04/13/2002-04/14/2002*	Flooding	County and region wide	Flooding occurred as a result of 1 to 3 inches of snowmelt and rainfall in the area. Many roads were washed out, and, in Royalton, 2 people were rescued after their vehicle was moved by flood waters.
06/27/1998	Flash flooding	County/region wide	3-6" of rain. Extensive flooding occurred along the White River and its branches.
07/13/1996*	Flooding	County and region wide	Region was hit by the remnants of Tropical Storm Bertha, which led to heavy rainfall and road washouts. In Royalton, a mudslide was report along Route 14.
06/28/1973 - 06/30/1973	Flooding	County-wide	5-8" County-wide.
11/02/1927 – 11/04/1927 ("The 1927 Flood")	Flash flooding	County-wide	4-9" of rain across the region. Approximately 7-8" in Royalton.

The Town of Royalton Flood Hazard Area Regulations prohibits new structures in the floodplain and fluvial erosion/stream buffer zones and places restrictions on other types of activities within the Special Flood Hazard Area. It also specifies land, area and structural requirements in the Special Flood Hazard Area and Fluvial Erosion Hazard zones. While the Town of Royalton lacks zoning regulations, the Town Plan does state that all development that is not essential to the running of agriculture, forestry, recreation and wildlife protection is to be restricted in floodways. Additionally, expansion of commercial development in the designated Flood Hazard/Shoreland area shall not be permitted, and restrictions are to be placed on other newly built properties. The Plan states that construction of new properties within the 100-year floodplain is not an appropriate use of the land.

There are 58 residential (eighteen mobile homes, thirty-nine single-family dwellings and one seasonal home) and 8 commercial structures (including at least two commercial farms and commercially important agricultural lands) in the 500 year floodplain, which equal \$11,387,610 if all properties were damaged/destroyed in a severe flooding event. The 500 year floodplain was chosen as a basis for this analysis to demonstrate the number of Royalton properties that are or may be vulnerable to flooding. In addition, the flooding that occurred as a result of Tropical Storm Irene is considered to be greater than a 100-year flood. Therefore, in order to be more forward-looking, the damage to structures in the 500-year floodplain is documented in this plan.

Due to the development restrictions mountainous terrain places on an area, "at-risk populations," such as children or the elderly, low-income housing and critical infrastructure may be located in flood hazard areas. Across Vermont, most child and elder care facilities are not registered with the State. Much of the child day care is likely private and in-home in Royalton, but there are three licensed facilities within the Town: Magic Mountain Children's Center, the South Royalton Preschool, and the South Royalton Afterschool Program. None of these facilities are located in a FEMA designated floodplain. There are two elder care or elder housing facilities in the Town of Royalton: Gifford Adult Day Program and

Brightwood House. Neither of these facilities are located in the floodplain. Finally, low-income housing is not registered with the State, and there are three mobile home parks in Royalton: Eaton’s Mobile Home Park, Jacobs Park and Riverbend Park. Eaton’s Mobile Home Park is located in the 100-year floodplain.

Recent studies have shown that the majority of flood damage in Vermont is occurring along upland streams, as well as along road drainage systems that fail to convey the amount of water they are receiving. These areas are often not recognized as being flood prone and property owners in these areas are not typically required to have flood insurance (DHCA, 1998). It should be noted that although small, mountainous streams may not be mapped by FEMA in NFIP FIRMs (Flood Insurance Rate Map), flooding along these streams is possible, and should be expected and planned for. Flash flooding in these reaches can be very erosive, causing damage to road infrastructure and to topographic features including stream beds and the sides of hills and mountains. The presence of undersized or blocked culverts can lead to further erosion and stream bank/mountain side undercutting. Furthermore, precipitation trend analysis suggests that intense, local storms are occurring more frequently. In the Town of Royalton, there no structures located in the mapped Fluvial Erosion Hazard Area.

A number of culverts have been replaced or upgraded since Royalton’s 2011 Annex was adopted. In an attempt to improve the flow of floodwater through the Town, Royalton upgraded culverts in the last few years on the following roads: Broad Brook Road, Davis Road, Happy Hollow Road, Johnson Hill Road, Oxbow Road, and Rix Road. Many of Royalton’s major roads run alongside the main stem of the White River and its tributaries, such as Route 14, the upper part of North Windsor Street, and South Windsor Street, Royalton Hill, Gillman Road, and Route 110 are especially vulnerable to erosion and washouts. The roads within the Town of Royalton that regularly flood include: South Windsor Street, Bridge Street, and Route 14.

The last official culvert inventory completed for the Town of Royalton was in 2013. Royalton routinely updates their culvert inventory with newly created and repaired culvert listings. The process of upgrading culverts is ongoing, and there were four culvert updates in 2013.

There is a development project in Royalton, on Moses Lane, which is in an area that may be vulnerable to flooding. There are no repetitive loss properties in Royalton on FEMA’s NFIP list.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Flash Flood/ Flood/ Fluvial Erosion	Areas surrounding Royalton and South Royalton. Roads that regularly flood include: South Windsor Street, Bridge Street, and Route 14. Many other roads are subject to erosional flooding.	Culverts, bridges, road infrastructure, public and private property. 58 residences and 8 commercial structures within the 500 year floodplain.	Worst recorded event was 1927 flood. Most recent severe event was TS Irene, which caused 4-5” of rainfall in Royalton.	From TS Irene: \$2,001,570.06 for Royalton from FEMA’s Public Assistance database (captures at least 70% of the overall total).	Highly likely

3. Water Supply Contamination

The majority of town and individuals in Vermont use groundwater as their primary source of water. While groundwater is more protected from contamination than surface water and is generally of a high quality, groundwater is still at risk of contamination from a number of point and non-point sources. Sources of surface contamination located directly above the aquifer may leach through the soil and into the groundwater, or groundwater contamination from another distant source may migrate, and consequently, contaminate a town or individual's water supply.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Water Supply Contamination**.

The migration of contaminants is made more complex because the patterns of groundwater movement, and their relationship to surface water movement, are not completely understood. This creates the potential for groundwater supplies to become contaminated from discrete and unknown sources. It is important to protect groundwater supplies from contamination to the greatest extent possible, because, once contaminated, it is difficult and expensive to clean them to the point where they are again suitable for drinking water.

The following data was retrieved from the Vermont Department of Environmental Conservation's Spill List. It includes some data copied from the Hazard Materials Spill section of this Plan discussed later because the spilling of any hazardous materials also has the potential to contaminate the water supply for the Town of Royalton.

History of Occurrences:

Date	Event	Location	Extent
07/04/2014	Hazardous Material Spill	Route 107	Approximately 5 gallons of mineral oil dielectric fluid (MODF) leaked from transformer.
05/06/2014	Gasoline spill	Route 107	Significant evidence of release of an unknown quantity of gasoline during piping inspection. PID readings >2000 ppm under dispensers. Blown primary line previously reported for mid-grade UST. Unclear if mid-grade was responsible for that release. Grossly impacted soil >2000 ppm being segregated from lower PID (100's ppm) and marginally impacted soil (<50).
11/06/2013	Above ground tank leak/failure	Upper Eaton Trailer Park	Approximately 170 gallons of #2 fuel oil released from outdoor AST, possibly from vandalism/theft attempt.
1/25/2012	Washed up storage tanks	Atlantic Plywood on Route 14	Containers washed onto property from the White River during TS Irene: 275 gallon & 500 gallon No. 2 fuel oil ASTs both with liquid; two propane tanks, one a 1,000 gallon Dead River tank and the other a 500 gallon unmarked one; and two drums with liquid, 55-gallon and 20-gallon poly.
10/6/2011	Petroleum drums under bridge	Bridge #30, Royalton Hill Road	Petroleum drums were found wedged under bridge as a result of TS Irene.
5/1/2009	Illegal dumping	Route 107	Illegal dumping in stream and burying/burning trash at a private residence.
8/18/2008	Diesel spill	Balla Machree Farm on Broad Brook Road	50 gallon diesel spill on property after a tractor tank was accidentally punched, causing a spill onto dirt and grass. Required excavation.

Date	Event	Location	Extent
7/24/2002	Transformer leak	Route	15 gallon transformer leak. CVPS cleaned up site with Speedi-Dri. Spill to asphalt, no migration.
11/23/2001	Diesel spill	Spirit of Health Center, Route 14	100 gallon diesel spill from a vehicle accident on Rt. 14. Royalton FD applied Speedi-Dri. Most fuel soaked into soil, requiring excavation.
3/10/1997	UST spill	S. Royalton School, S. Windsor St.	20 gallon spill of UST. Tank overflowed at the school, requiring soil excavation.
6/11/1994	Diesel spill	Route 14 (RR underpass)	20 gallons of diesel spilled along Rt. 14
6/10/1993	Petroleum spill	Mill Road	A petroleum odor was discovered in a well. Upon site visit, it was found the well had collapsed.
6/28/1974	Gasoline spill	Agway Bulk Plant	1,800 gallons of gas spilled after the gasoline tank was overfilled. The product was contained and cleaned up.

Royalton has public community water system, operated by the Royalton Fire District #1, providing 423 connections to an estimated population of 655 people in Royalton, South Royalton and areas along Routes 110 and 14. The system that is in place can support demand of up to approximately 130,000 gallons, which is 80,000 gallons in excess of the average daily demand of 50,000. The Town’s main water supply is an open man-made lake located in close proximity to the local Kent’s Ledge hiking trail, known as Lake John. The Treatment Plant is near the lake, and has a 200 gallon per minute filtration capacity. Water is also diverted from the White River via the Carpenter Field Infiltration Gallery.

The Wellhead Protection Plan enumerates potential sources of contamination for the Town’s water supply, denotes actions that have been taken to minimize the risk of groundwater contamination, and creates a Source Protection Area. This Area operates similar to a zoning district overlay, and prohibits certain activities that may contaminate the wellhead area, such as using herbicides. Property owners located in the Royalton Fire District #1 vicinity are informed of that fact, and offered assistance in the ways they can help minimize contamination into the groundwater supply. The list of hazardous materials spills, particularly on or near Routes 14 and 107, demonstrates the threat of contamination facing the Town’s municipal supplies from the White River, despite their well-intentioned efforts.

Private well contamination also threatens those residents and business owners who are not located in the village of Royalton, and maintain their own well for drinking water. As private wells are not required to develop a Wellhead Protection Plan or Source Protection Area, the activities nearby a property owner’s well are not necessarily regulated. While an individual property owner may only be affected by his or her well being contaminated by a small contamination source, a hazardous material spill may impact multiple wells. The list of hazardous material spills in the Town of Royalton demonstrates the ease with which private wells could be contaminated, even with a few gallons of hazardous material.

It is important to note that groundwater supplies can also become contaminated by bacteria from a number of sources. These sources may include: a poorly designed leach field, a ruptured septic tank, or over-application or improper storage of manure or fertilizer.

Hazard	Location	Vulnerability	Extent	Anticipated/Potential Impact	Likelihood/Probability
Water Supply Contamination	Royalton and South Royalton, private homes and businesses located throughout the Town.	Approximately 423 connections (655 people) connected to the Royalton Fire District #1 system.	Depends on the amount of and location of the source of contamination — may impact one individual’s well or the public water supply.	For individual homeowners who experience a heating oil spill, and the groundwater becomes contaminated: \$90,000 (according to the Massachusetts Dept. Environmental Protection). For the public water supply, it would depend on the type and extent of contamination. (To clean a very small water system of MTBE (a gasoline additive) over a 10 year period are estimated at \$500,000-\$1,000,000.) A new supply may also be sought (\$3/1000 gallons in small system and community wants a 65,000 gallon capacity) = \$195,000. The costs of medical treatment are not factored in here, but could be substantial.	Occasionally

4. Severe Weather

More common than hurricanes or tropical storms are severe thunderstorms (usually in the summer), which can cause flooding as noted above, and are associated with lightning, high winds, hail and tornadoes. Hailstorms have occurred in Vermont, usually during the summer months. While local in nature, these storms are especially significant to area farmers, who can lose entire fields of crops in a single hailstorm. Large hail is also capable of property damage. 382 hail events were recorded between 1950 and 2008 in the state, making hail an annual occurrence in some part of the state. Most of these events had hail measuring .75 inches, but many had hail at least 1.5 inches in size. The largest hail during the period was 3-inch hail that fell in Chittenden County in 1968 (NCDC). Tennis ball-sized hail was reported in the town of Chittenden during a storm in the summer of 2001. Thunderstorms can generate high winds, such as hit the region on July 6, 1999, downing hundreds of large trees in a few minutes.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Severe Weather**.

In Royalton, severe weather is quite common, typically in the late spring and summer months when the region experiences high temperatures. Severe thunderstorms tend to bring other hazards such as high winds, hail, lightning, and flooding, and these hazards are often experienced in combinations which create many unique weather and emergency management situations. Over the years, Royalton has been hit with high winds that have downed and uprooted numerous trees, and knocked out electricity to residents in the Town. Town specific wind data could not be found, but the “Remarks” section of

NCDC Database helps to illuminate the impact strong winds can have on Royalton. Sizeable hail has also accompanied storms moving through the Town and region.

The following list indicates the history of occurrence with regard to this hazard in Windsor County (given that small population of Royalton, town-specific data is limited); an asterisk “*” denotes the few instances in which town-specific data is available, and federal disaster numbers are listed when appropriate. In an attempt to capture the individual hazards that may arise, and the different circumstances caused by the hazards in concert, the separate hazards are documented in the table below.

History of Occurrences:

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
10/07/2013				✓		Royalton, County- and region-wide	Scattered wind gusts of 50 mph or greater across portions of Vermont produced numerous downed trees or tree limbs on utility lines resulting in more than 25,000 customers without power at the peak. Several reports of tree branches on utility lines in several communities in Windsor county, including Royalton.
09/11/2013	✓			✓		Royalton and South Royalton, County-wide	Trees and power lines down in Royalton and South Royalton.
Period from 06/25/2013— 07/11/2013 (DR 4140 VT)*	✓	✓	✓	✓		Royalton, County-wide	Severe storms over a nearly one month period. Rains caused flooding in the region, winds downed trees, power outages were reported. Damage totaling \$25,160.25 in Royalton. Washouts on Gage Road and a culvert replacement, Washouts on Post Farm Road, Clarksville Road. Washout and a culvert replacement on Mill Road. Most expensive was Mill Road work.
6/2/2013*	✓		✓	✓		Royalton, County-wide	A few trees and wires down along Happy Hollow road. Property damage estimated at \$5k.

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
9/8/2012*	✓			✓		Royalton, County-wide	There were numerous trees and power lines down in Royalton. Property damage estimated at \$10k.
7/17/2012*	✓		✓	✓		Royalton, County-wide	There were several trees down on Happy Hollow Road and Rainbow Street. Property damage estimated at \$5k.
5/29/2012	✓	✓	✓	✓		County-wide	Up to 3-5" of rainfall throughout the region with reports of hail greater than 1" diameter. Flash flooding reported in areas.
8/28/2011 (DR 4022 VT)*	✓	✓		✓		Royalton, County-wide	Tropical Storm Irene prompted wide-spread, devastating flooding throughout the region. Many roads were flooded, Diane Stoddard's house washed away.
5/31/2009	✓		✓	✓		County-wide	40-55mph wind gusts and hail caused fallen trees and power outages in the region.
7/21/2008—8/12/2008 (DR 1790 VT)	✓			✓		County-wide	Severe storms and flooding impacted Windsor and surrounding counties.
6/27/2007*	✓		✓	✓		Royalton, County-wide	Storms caused several trees to be blown down on Happy Hollow Road and Rainbow Street.
6/19/2007*	✓			✓		Royalton, County-wide	Severe storms and strong winds caused numerous downed trees and powerlines in Royalton. Property damage estimated at \$10k.
9/16/1999—9/21/1999 (DR 1306 VT)		✓		✓		County-wide	Tropical Storm Floyd's rains and winds caused road and culvert washouts.
7/13/1996*	✓	✓				Royalton, County-wide	Remnants of Tropical Storm Bertha hit VT. A mudslide was reported on Rt. 14 near Royalton amongst other damage.
7/6/1973 (DR 397 VT)		✓		✓		County-wide	One of the largest flood events of the 20 th century in VT. Landslides reported in the region.
11/3/1927	✓	✓				County-wide	"Great Flood of 1927." Worst recorded flood in VT. White River crested at a record of 29.30 feet.

The main hazard caused by severe weather throughout the Town is flooding. The most recent flooding event occurred over three weeks in late June and early to mid-July in 2013. The flooding was widespread and severe enough for a Federal Disaster Declaration, DR-4140, to be issued for Windsor and other counties in Vermont. The road and infrastructure damaged during this flooding event was located on; Gage Road, Post Farm Road, Clarksville Road and Mill Road.

The Town maintains an up-to-date culvert inventory and its work to upgrade culverts remains in process. Culverts on Happy Hollow Road, Post Farm Road and Gage Road have been upgraded recently. A number of the steel culverts have been replaced with plastic culverts. There are also three pending culvert upgrades on Johnson Hill Road, on Urdstadt Road and another culvert on Happy Hollow Road.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/ Probability
Severe Weather	Town wide for wind, hail, high winds, lightning and thunderstorm impacts. For flooding, the following roads/areas: the upper part of North Windsor Street, and South Windsor Street, Royalton Hill, Gillman Road, Route 110, Bridge Street, and Route 14.	Town and private buildings, and utilities; culverts, bridges, road infrastructure	Most recent, Tropical Storm Irene- 4-5" of rainfall in Royalton.	From TS Irene: \$2,001,570.06 for Royalton from FEMA's Public Assistance database (captures at least 70% of the overall damage total). Royalton Listers assessed damage at approximately \$3 million.	Highly likely

****Note:** The main hazard caused by severe weather is typically flooding (though not always). In addition, flooding is often the most expensive hazard caused by severe weather. Therefore, the Extent and Impact categories for Severe Weather will reflect the data reported in the Flash Flood/Flood/Fluvial Erosion, as it represents the higher limits of damage caused by severe weather.

5. Hazardous Materials Spill

Based on available VT Tier II data, there are five sites in town that have sufficient types and/or quantities of hazardous materials to require reporting. Royalton’s village is located along Rt. 14 north of the White River, and South Royalton is on the opposite side of the river. I-89 passes close to South

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Hazardous Materials Spill**.

Royalton, and there are railways running directly through South Royalton in close proximity to businesses, roadways, homes, town offices and less than a half-mile from the White River. There are 683 residential and 147 commercial, industrial or public buildings within 1,000 feet of a potential HAZMAT spill on I-89, Routes 14 and 107, local Class 2 roads, and the railroad. In the event that 5% of these structures were involved in a HAZMAT incident, the estimated damage would be \$8,202,970. These structures include the South Royalton School, Vermont Law School, the Royalton Academy building (also the Town’s Red Cross/Emergency Shelter) the fire and rescue station, the town hall, a number of places of worship, and several businesses, including GW Plastics. It should also be noted that the State of Vermont currently has one fully trained HAZMAT response team, with vehicles located in Essex Junction, Brandon, and Windsor. The HAZMAT crew chief is available within minutes of a call for the team but on-scene response would be a matter of hours. In the event of a serious accident in town, there would be little time for evacuation and response would be difficult.

The following data was retrieved from the Vermont Department of Environmental Conservation’s Spill List and by searching the archives of local newspapers. The table above is used to illustrate the ease with which trucks, trains and the day-to-day activities in the Town have the potential to create a hazardous material spill and dangerous conditions for emergency responders and town residents.

History of Occurrences:

Date	Event	Location	Extent
07/04/2014	Hazardous Material Spill	Route 107	Approximately 5 gallons of mineral oil dielectric fluid (MODF) leaked from transformer.
05/06/2014	Gasoline spill	Route 107	Significant evidence of release of an unknown quantity of gasoline during piping inspection. PID readings >2000 ppm under dispensers. Blown primary line previously reported for mid-grade UST. Unclear if mid-grade was responsible for that release. Grossly impacted soil >2000 ppm being segregated from lower PID (100's ppm) and marginally impacted soil (<50).
11/06/2013	Above ground tank leak/failure	Upper Eaton Trailer Park	Approximately 170 gallons of #2 fuel oil released from outdoor AST, possibly from vandalism/theft attempt.
1/25/2012	Washed up storage tanks	Atlantic Plywood on Route 14	Containers washed onto property from the White River during TS Irene: 275 gallon & 500 gallon No. 2 fuel oil ASTs both with liquid; two propane tanks, one a 1,000 gallon Dead River tank and the other a 500 gallon unmarked one; and two drums with liquid, 55-gallon and 20-gallon poly.
6/5/2012	Potential heating oil spill	Carney Road	~100 gallons of heating oil found in 1,000 gallon septic tank on for-sale property. Residually impacted soil deemed to not pose a significant risk to public health—would naturally attenuate with time.

Date	Event	Location	Extent
8/18/2008	Diesel spill	Balla Machree Farm on Broad Brook Road	50 gallon diesel spill on property after a tractor tank was accidentally punched, casing a spill onto dirt and grass. Required excavation.
2/3/2006	Hydraulic line leak	Gee Hill Road	20 gallon hydraulic line leak; Verizon responsible party for spill.
7/24/2002	Transformer leak	Route 14	15 gallon transformer leak. CVPS cleaned up site with Speedi-Dri. Spill to asphalt, no migration.
11/23/2001	Diesel spill	Spirit of Health Center, Route 14	100 gallon diesel spill from a vehicle accident on Rt. 14. Royalton FD applied Speedi-Dri. Most fuel soaked into soil, requiring excavation.
7/9/2001	Diesel spill	Chelsea St.	50 gallons of diesel leaked.
3/10/1997	UST spill	S. Royalton School, S. Windsor St.	20 gallon spill of UST. Tank overflowed at the school, requiring soil excavation.
6/11/1994	Diesel spill	Route 14 (RR underpass)	20 gallons of diesel spilled along Route 14
6/28/1974	Gasoline spill	Agway Bulk Plant	1,800 gallons of gas spilled after the gasoline tank was overfilled. The product was contained and cleaned up.

Although no major spills consisting of hundreds of gallons of hazardous material have occurred in the Town of Royalton, the potential for a major spill exists. One of the major risk-areas in the Town of Royalton is along Route 14. This corridor poses a constant threat to the Town of Royalton. Route 14 serves as the main thoroughfare for trucks and other motor vehicles transporting a wide-range of goods, including a wide range of hazardous materials, within the confines of Royalton. A truck accident and a resulting hazardous material spill could be exceedingly disastrous for the Town and its residents. The majority of Route 14 in the Town of Royalton is built very close to the White River, which could create additional water contamination problems if a hazardous material spill occurred on Route 14.

Route 107 also runs through a portion of Royalton, roughly parallel to the river. I-89 passes over this portion of the town, where on- and off-ramps to the highway are located in proximity of a local gas station and solid waste facility. The same concerns that are present along the Route 14 corridor apply to the portion of Route 107 passing through Royalton. Additionally, Chelsea Street in South Royalton, which runs perpendicular to Route 14, has a bridge spanning the White River. During Tropical Storm Irene, there were fears for the integrity of the bridge, which had a number of tanks, some carrying flammable or combustible liquids, collide with the bridge amidst rising floodwaters. Damage to this bridge would severely impede access to South Royalton.

The New England Central Railroad and Amtrak trains run through the village and Town of Royalton over five miles of track line. At any given time, there can be hazardous materials aboard the train. As the trains travel through Royalton, they bring not only the daily Amtrak passenger train but several freight trains, some carrying propane and other hazardous cargo. Railroads are not required to disclose the materials they transport through Towns and Cities in Vermont. Due to the terrain and location of the rail bed, access to the railroad corridor in some parts of Town is very difficult. Therefore, in the event of a hazardous material spill or railroad accident, it may be challenging for emergency responders to quickly respond to the situation.

In order to prepare for hazardous material spills in Royalton, six members of the South Royalton Volunteer Fire Department are trained to the HAZMAT Awareness level and five to the HAZMAT Operations level.

Hazard	Location	Vulnerability	Extent	Anticipated Impact	Likelihood/Probability
Hazardous Materials Spill	I-89, Route 14, Route 107, railways running along the White River.	Road and rail infrastructure, nearby structures (ex. Town Garage if fuel tank struck), White River.	Initially, local impacts only; but depending on material spilled, extent of damage may spread (ex. into groundwater)	Within 1,000 feet of the railroad tracks, I-89, Rtes. 14 and 107, and other Class 2 roads, there are 683 residences and 147 commercial, industrial or public buildings. In the event that 5% of these structures were involved in a HAZMAT incident, the estimated damage would be \$8,202,970.	Occasionally

VI. Mitigation

A. Mitigation Goals

1. To reduce injury and losses from the hazard of structural fire(s).
2. To reduce injury and losses from the natural hazard of flash flooding, flooding, and fluvial erosion.
3. To reduce injury and losses from the hazard of water supply contamination.
4. To reduce injury and losses from the natural hazard of severe weather.
5. To reduce injury and losses from the hazard of hazardous material spills.

B. Town Plan Goals & Objectives Supporting Local Hazard Mitigation

- To supply data and solutions for planning issues (p. 3).
- To recommend future planning studies and funding sources (p. 3).
- To identify, protect and preserve the natural and historic resources of Royalton (p. 9).
- To plan for, finance, and provide an efficient system of community facilities and services to meet future needs of the citizens and visitors of Royalton (p. 17).
- To improve the quality of Royalton's transportation and road systems in order to promote safety, alleviate congestion and to maintain the scenic quality of roads wherever possible (p. 43).
- To manage growth and development in a manner that protects Royalton's natural resources and the environment, preserves the area's historic and cultural assets, and does not strain municipal facilities and services (p. 51).
- To plan for the harmonious development of the region and to work with neighboring towns to address mutual concerns (p. 58).

The Royalton Town Plan was updated and adopted on March 2, 2010, and has a 5 year lifespan.

C. Hazard Mitigation Strategies: Programs, Projects & Activities

Vermont Division of Emergency Management & Homeland Security encourages a collaborative approach to achieving mitigation at the local level through partnerships with Vermont Agency of Natural Resources, VTTrans, Vermont Agency of Commerce and Community Development, Regional Planning Commissions, FEMA Region 1 and others. That said, these agencies and organizations can work together to provide assistance and resources to towns interested in pursuing hazard mitigation projects.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii), 201.6(c)(3)(iii) and 201.6(c)(3)(iv).

With each mitigation strategy, general details about the following are provided: local leadership, possible resources, implementation tools, and prioritization. The prioritization category is based upon the economic impact of the action, the Royalton’s need to address the issue, the cost of implementing the strategy, and the availability of potential funding. The cost of the strategy was evaluated in relation to its benefit as outlined in the STAPLEE guidelines.

Strategies given a “High” prioritization indicate they are either critical or potential funding is readily available, and should have a timeframe of implementation of less than two years. A “Medium” prioritization indicates that a strategy is less critical or the potential funding is not readily available, and has a timeframe for implementation of more than two years but less than four. A “Low” prioritization indicates that the timeframe for implementation of the action, given the action’s cost, availability of funding, and the community’s need to address the issue, is more than four years.

The Town of Royalton understands that in order to apply for FEMA funding for mitigation projects that a project must meet more formal FEMA benefit cost criteria, and a project seeking FEMA funds will undergo a full benefit-cost assessment in the FEMA-approved format. The Town must have a FEMA approved Hazard Mitigation Plan as well.

The following strategies will be incorporated into the Town of Royalton’s long-term land use and development planning documents. In addition, the Town will review and incorporate elements of this Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ fluvial erosion hazards (FEH) bylaws. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas.

Hazard(s) Mitigated	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
All Hazards	<i>Ensure that Royalton's Local Emergency Operations Plan (LEOP) is kept up-to-date and identifies vulnerable areas and references this Plan.</i>	Emergency Management Coordinator; Town Finance and Administration Manager	High	Local resources; TRORC	Annually
	<i>Consistently document infrastructure damage after weather events.</i>	Town Finance and Administration Manager in coordination with the Road Foreman	High	Local resources	As needed
	<i>Install a generator at the fire house.</i>	Royalton Fire District #1	High	Local resources; HMGP generator grant	1-2 years
	<i>Seek and participate in trainings for town official; including but not limited to table top exercises.</i>	Emergency Management Coordinator with liaison	High	Local resources; state resources	At least annually or as needed
Structural Fire	<i>Maintain mutual aid agreements with surrounding towns.</i>	Royalton Fire District #1	High	Local resources	Annually
	<i>Ensure that all firefighters have and maintain up-to-date training.</i>	Royalton Fire District #1	High	Local resources; state resources	Annually
	<i>Install dry hydrant sites for structure fire protection (ex. Johnson/Royalton Hill Road area, and Russ Hill Road area).</i>	Royalton Fire District #1	High	Local resources; state resources	Annually
Water Supply Contamination	<i>Continue to maintain and update the Royalton Fire District No. 1 Source Protection Plan.</i>	Royalton Fire District #1	High	Local resources; state resources	2015—1 year

Hazard(s) Mitigated	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Water Supply Contamination	<i>Replace filters on the Royalton Fire District's water system.</i>	<i>Royalton Fire District #1</i>	High	<i>Local resources; state resources; grant opportunities</i>	<i>1 year (FY 2015)</i>
	<i>Upgrade Lake John Dam.</i>	<i>Royalton Fire District</i>	High	<i>Local resources; state resources; grant opportunities</i>	<i>1 year (FY 2015)</i>
Severe Weather (High Wind)	<i>Clear and maintain town road rights-of-way, and work with local utilities to request that utility corridors are cleared and maintained, as needed.</i>	<i>Road Foreman</i>	Medium	<i>Local resources; Green Mountain Power</i>	<i>As needed</i>
Flash Flood/Flood/Fluvial Erosion// Severe Weather	<i>Maintain and update town bridge and culvert inventories. Regularly inspect and maintain town bridges and culverts; and develop a schedule to replace undersized culverts.</i>	<i>Road Foreman</i>	High	<i>Local resources; VTrans</i>	<i>Annually</i>
	<i>As part of the Town Plan updates, consider revising and strengthening the Town's Flood Hazard Area Regulations to include River Corridors.</i>	<i>Planning Commission and Selectboard</i>	Low	<i>Local resources; Municipal Planning Grants</i>	<i>5 years</i>
	<i>Relocate 1000-foot section of Gilman Road to reduce the potential for flood damage and improve the resilience of the road to future damage.</i>	<i>Town Finance and Administration Manager; Road Foreman; Selectboard</i>	Medium	<i>Local resources; TRORC; HMGP and PDM grants; HUD's Community Development Block Grant—Disaster Recovery</i>	<i>1-4 years</i>

Hazard(s) Mitigated	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Flash Flood/Flood/Fluvial Erosion// Severe Weather	<i>Permanently keep Pearley Road at its current location (it was temporarily relocated from its original location due to flood damage) and stabilize the river bank. The road's current location is much further from the river than its original location and will help reduce future flood damage.</i>	Town Finance and Administration Manager; Road Foreman; Selectboard	Medium	Local resources; TRORC; HMGP and PDM grants	2-4 years
	<i>Complete major culvert project on Happy Hollow Road and Urstadt (Broad Brook Road). This upgrade project will improve the flow of flood waters through this area.</i>	Town Finance and Administration Manager; Road Foreman; Selectboard	High	Local resources; state resources; HMGP and PDM grants	1-2 years
	<i>Install or restore stream buffers in the following locations to improve flood resilience:</i> <ul style="list-style-type: none"> • <i>Confluence of White River and Second Branch of the White River</i> • <i>Site of Marx Property Buyout</i> • <i>Meadow Lane</i> • <i>Area upstream of South Royalton School</i> 	Town Finance and Administration Manager; Planning Commission	Medium	Local resources; White River Partnership; Vermont Ecosystem Restoration Program Grants	2-4 years
	<i>Conserve farm field upstream of South Royalton village to help ensure flood storage in high flows.</i>	Town Finance and Administration Manager; Planning Commission; Conservation Commission	Medium	Local resources; White River Partnership; Vermont Ecosystem Restoration Program Grants	2-4 years
	<i>Conserve mile-long stretch of mature stream buffer, north of the intersection of Routes 14 and 107 in Royalton.</i>	Town Finance and Administration Manager; Planning Commission; Conservation Commission	Medium	Local resources; White River Partnership; Vermont Ecosystem Restoration Program Grants	2-4 years

Hazard(s) Mitigated	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Flash Flood/Flood/Fluvial Erosion// Severe Weather	<i>For the Fox Stand Bridge, improve/upgrade bridge approaches and/or bridge to span bank-full width, which will reduce the structure's vulnerability to washouts during high flows.</i>	Town Finance and Administration Manager; Planning Commission; Conservation Commission	Medium	Local resources; White River Partnership; Vermont Ecosystem Restoration Program Grants	2-4 years
	<i>For the Royalton Bridge, improve/upgrade bridge approaches and/or bridge to span bank-full width, which will reduce the structure's vulnerability to washouts during high flows. This will also help alleviate pressure placed on Back River Road.</i>	Town Finance and Administration Manager; Planning Commission; Conservation Commission	Medium	Local resources; White River Partnership; Vermont Ecosystem Restoration Program Grants	2-4 years
Hazardous Material Spill	<i>Ensure that all emergency response and management personnel continue to receive HAZMAT Awareness training at a minimum.</i>	Royalton Fire District #1	High	Local resources	Yearly
	<i>Study emergency access points to the railroad corridor in locations where access is presently difficult in the event of a derailment. In particular, Route 107 near the state VTrans garage, there is a stretch of railroad that is not accessible by vehicles.</i>	Emergency Management Coordinator	Low	Local resources	4-5 years
	<i>Research and participate in hazardous material spill-related seminars and table-top exercises.</i>	Emergency Management Coordinator; Royalton Fire District #1	Low	Local resources; state resources	4-5 years

Certificate of Adoption

The Town of Royalton
Select Board
A Resolution Adopting the Local Hazard Mitigation Plan
_____, 2014

WHEREAS, the Town of Royalton has worked with the Two Rivers-Ottawaquechee Regional Commission to identify hazards, analyze past and potential future losses due to natural and manmade-caused disasters, and identify strategies for mitigating future losses; and

WHEREAS, the Royalton Local Hazard Mitigation Plan contains several potential projects to mitigate damage from disasters that could occur in the Town of Royalton; and

WHEREAS, a duly-noticed public meeting was held by the Town of Royalton Select Board on _____, 2014 to formally adopt the Royalton Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the Royalton Select Board adopts the Royalton Local Hazard Mitigation Plan Update.

Chair of Select Board

Member of Select Board

ATTEST

Appendices

Appendix A: Hazard Ranking Methodology

<u>Frequency of Occurrence</u> Probability	<u>Warning Time</u> Amount of time generally given to alert people to hazard	<u>Potential Impact</u> Severity and extent of damage and disruption
<p>1 = <i>Unlikely</i> <1% probability of occurrence in the next 100 years</p> <p>2 = <i>Occasionally</i> 1–10% probability of occurrence per year, or at least one chance in next 100 years</p> <p>3 = <i>Likely</i> >10% but <100% probability per year, at least 1 chance in next 10 years</p> <p>4 = <i>Highly Likely</i> 100% probable in a year</p>	<p>1 = More than 12 hours</p> <p>2 = 6–12 hours</p> <p>3 = 3–6 hours</p> <p>4 = None–Minimal</p>	<p>1 = <i>Negligible</i> Isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, and potential for minor injuries</p> <p>2 = <i>Minor</i> Isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, and potential for injuries</p> <p>3 = <i>Moderate</i> Severe property damage on a neighborhood scale, temporary shutdown of critical facilities, and/or injuries or fatalities</p> <p>4 = <i>Major</i> Severe property damage on a metropolitan or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities</p>

Appendix B: Critical Stream Crossings

Critical crossings group one includes stream crossing structures on town highways that cross third order streams or larger. Headwater streams generally include first through third order. Third order was included as these headwater streams will have larger drainage areas and may have larger structures that are more difficult to replace and have a larger impact on the road network. Many of these are bridges.

RDFLNAME	STRUCT_NUM	OWNER_FIPS	CATEGORY	LONGITUDE	LATITUDE	STR_TYPE	STR_MAT	CUL_WIDTH	CUL_HEIGHT	CUL_LEN
BACK RIVER RD	600050001514161	27080	C	-72.5567	43.8061	Round	Steel Corrugated	60	60	50
BACK RIVER RD	400050002914161	27080	C	-72.5775	43.8135	Round	Steel Corrugated	84	84	80
BRIDGE ST	101416003114161	27080	B	-72.5444	43.8137			0	0	0
BROAD BROOK RD	101416000214161	27080	B	-72.5166	43.7839			0	0	0
CHELSEA ST	101416000314161	27080	B	-72.5192	43.8229			0	0	0
JOHNSON HILL RD	600109002314161	27080	C	-72.5637	43.781	Round	Steel Corrugated	18	18	30
LOVEJOY RD	101416002614161	27080	B	-72.5273	43.7707			0	0	0
MILL RD	101416002714161	27080	B	-72.5138	43.8322			0	0	0
MILL RD	400056001814161	27080	C	-72.5214	43.8468	Box	Concrete	120	120	20
PARKHURST RD	101416002514161	27080	B	-72.5282	43.7683			0	0	0
RIX RD	600051002314161	27080	C	-72.5257	43.8485	Round	Steel Corrugated	15	15	25
RIX RD	600051000314161	27080	C	-72.5419	43.8608	Round	Steel Corrugated	60	60	30
ROYALTON HILL RD	101416003014161	27080	B	-72.5661	43.8226			0	0	0
ROYALTON HILL RD	600034000714161	27080	C	-72.5817	43.8105	Box	Concrete	60	100	20
TH-92	101416002914161	27080	B	-72.5118	43.8429			0	0	0
TH-93	101416002814161	27080	B	-72.5112	43.8485			0	0	0
WATERMAN RD	600023001014161	27080	C	-72.5897	43.8392	Round	Steel Corrugated	36	36	30

Critical crossings group two includes significantly undersized structures, usually culverts, were identified from the ANR-DEC stream geomorphic assessment survey with openness ratios less than 50%. This measure refers to when structure's width is less than half of the stream bankfull width. Several of these structures may have been damaged during TS Irene or other events and may have been replaced. The town, at some point, should look at these sites and assess their status and need for repair/upgrades.

RDFLNAME	OWNER_FIPS	CATEGORY	LONGITUDE	LATITUDE	STR_TYPE	STR_MAT	CUL_WIDTH	CUL_HEIGHT	CUL_LEN	OpennessR	ChannelWid	
BROAD BROOK RD	27080	C	-72.5273	43.7734	Box	Stone	30	36	24	0.35	7	
BROAD BROOK RD	27080	C	-72.525	43.7792			0	36	36	40	0.38	6
FRARY RD	27080	C	-72.5311	43.7906			0	24	24	42	0.095238	2
FRARY RD	27080	C	-72.522	43.7844	Round	Steel Corrugated	36	36	40	0.25	7	
JOHNSON HILL RD	27080	C	-72.5695	43.7821	Round	Steel Corrugated	32	32	25	0.3	4	
MILL RD	27080	C	-72.5212	43.8474			0	36	36	23	0.391304	9
OXBOW RD	27080	C	-72.5236	43.8024			0	36	36	30	0.25	5
POST FARM RD	27080	C	-72.5717	43.8623			0	36	36	110	0.145455	13
RUSS HILL RD	27080	C	-72.5627	43.8453	Round	Steel Corrugated	36	36	37	0.378378	8	

Attachments

Attachment A: Map of the Town of Royalton